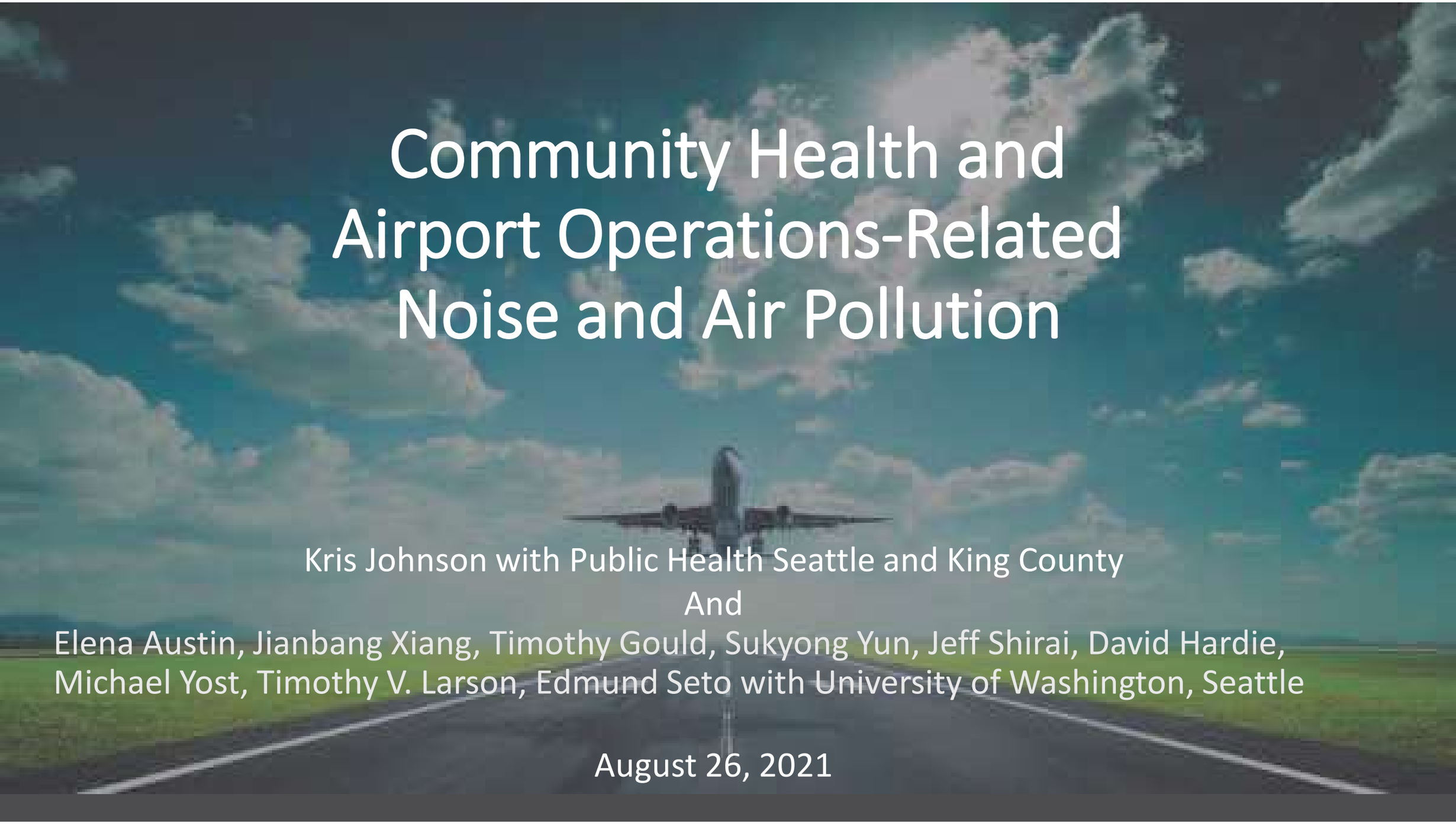


Community Health and Airport Operations-Related Noise and Air Pollution

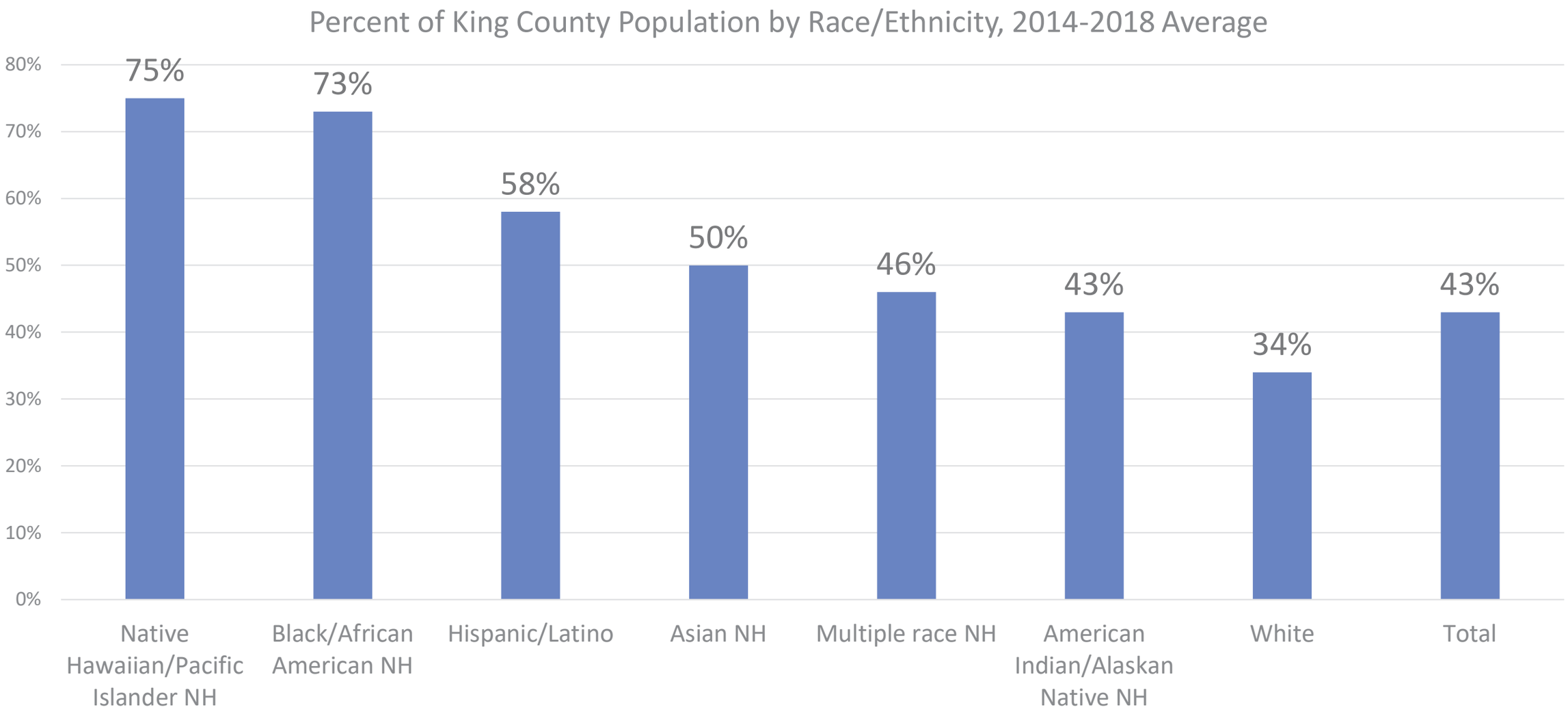
Kris Johnson with Public Health Seattle and King County
And
Elena Austin, Jianbang Xiang, Timothy Gould, Sukyong Yun, Jeff Shirai, David Hardie, Michael Yost, Timothy V. Larson, Edmund Seto with University of Washington, Seattle

August 26, 2021

Understanding the community health effects of pollution related to Seattle-Tacoma International Airport (SeaTac) operations

a) Airport community health profiles
b) Strength of evidence to date
c) UW School of Public Health Study on UFP
d) Recommendations to address health issues

The airport communities are home to a majority of King County's people of color



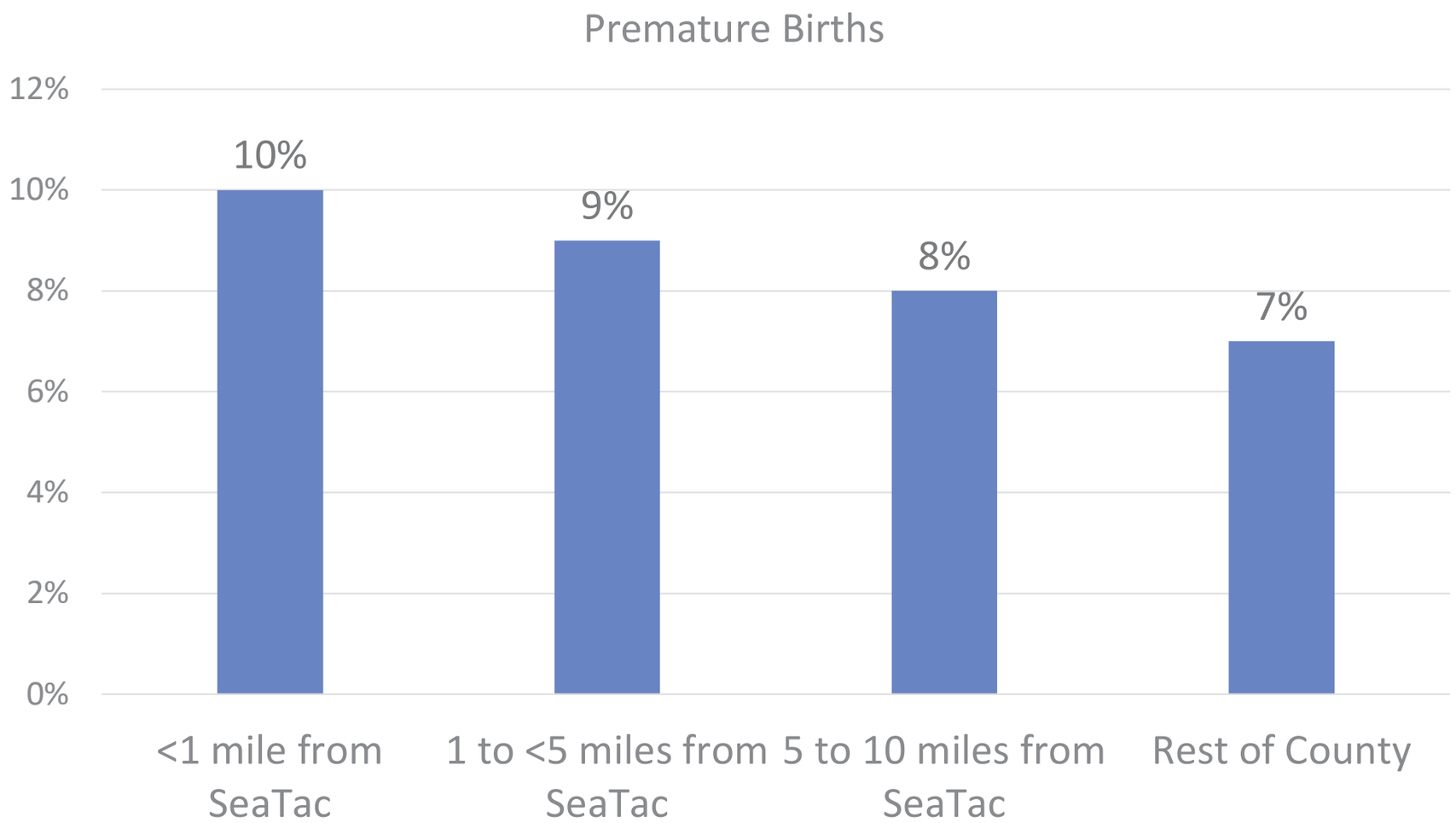
Compared to the rest of the county, people in airport communities face disparities in

- Health
- Health risk factors
- Resources

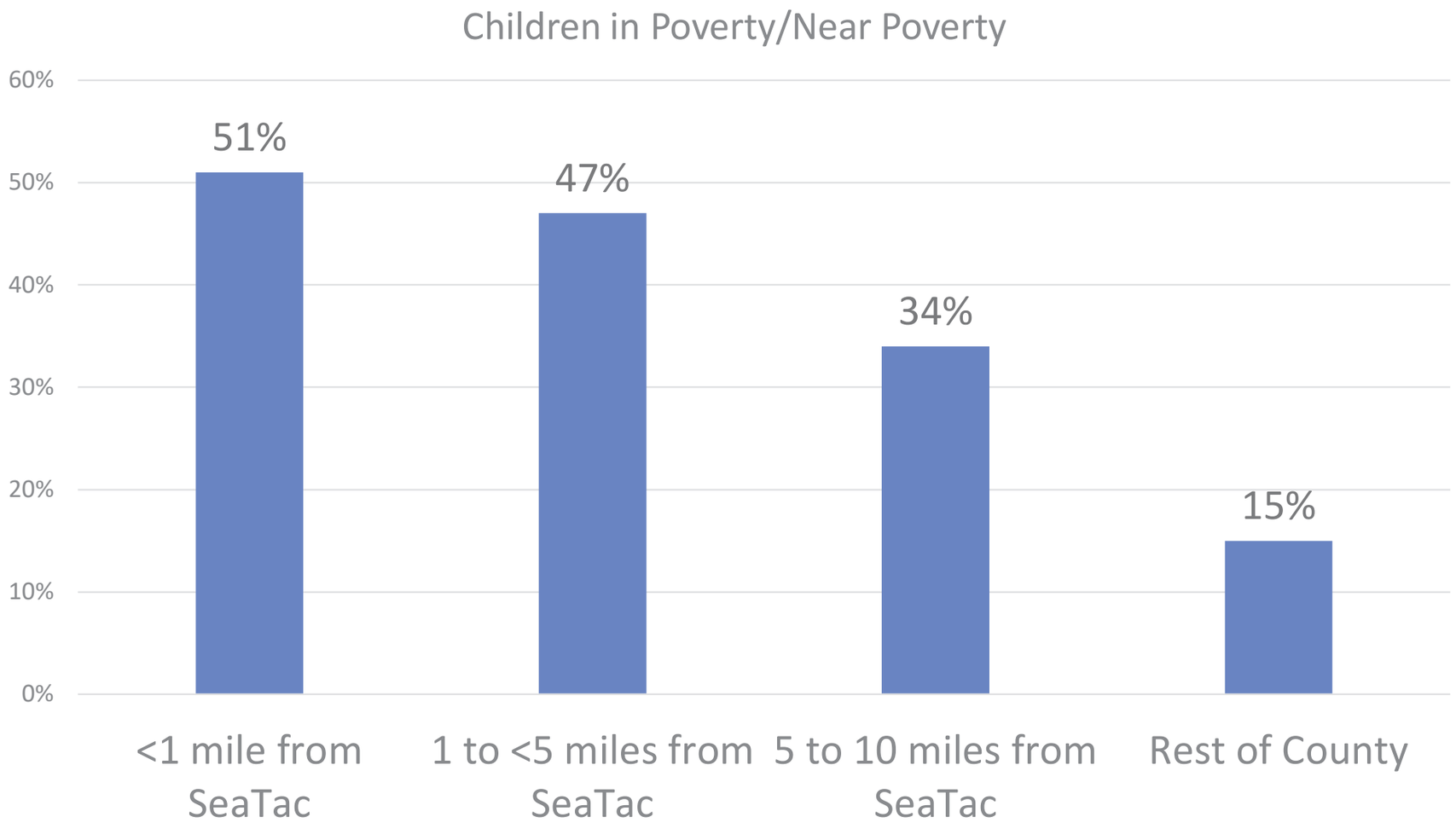
For some measures, health outcomes worsened with proximity to airport

- Hospitalization rates for heart disease
- Rate of death from all causes
- Rate of death from heart disease
- Life expectancy (2-5 years lower for airport communities)

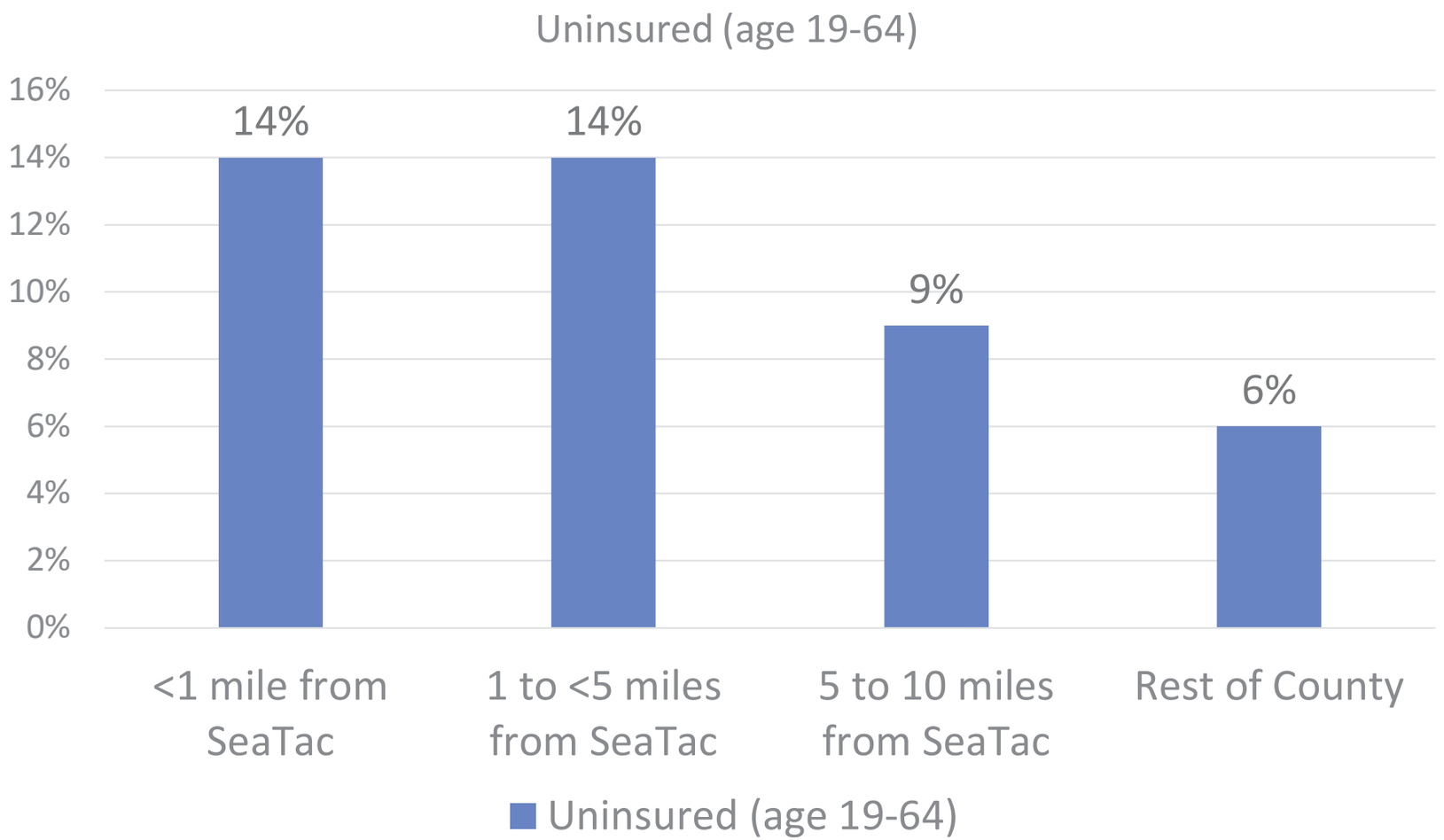
Mothers in airport communities were 43% more likely to have a premature birth than the rest of King County



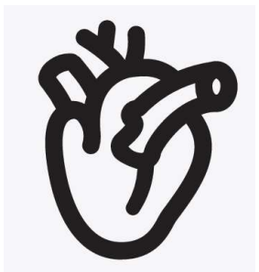
Airport communities had twice as many children living in poverty or near poverty than the rest of King County

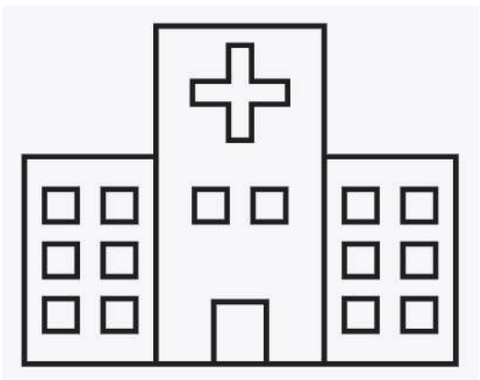


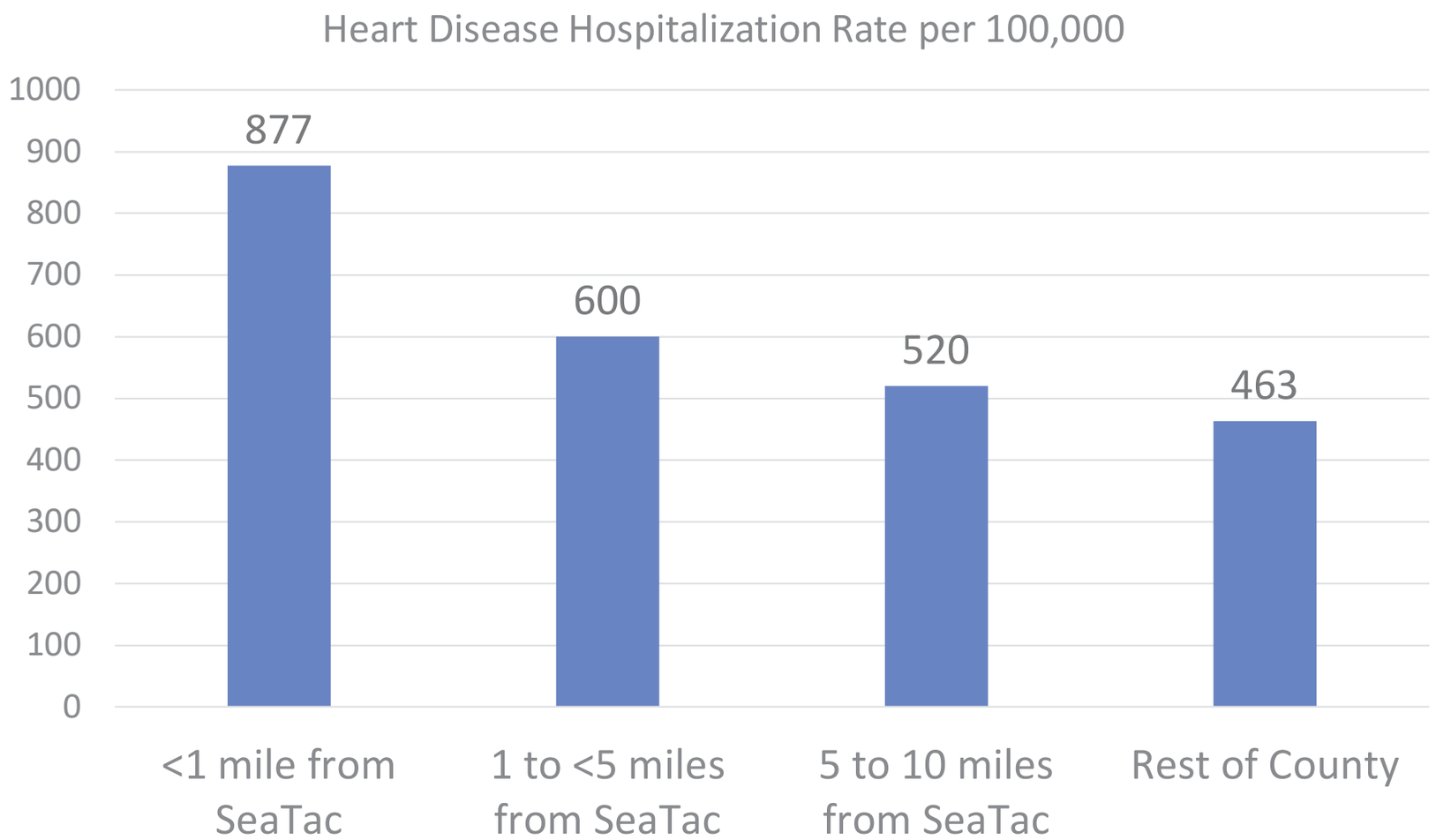
Adults were more likely to be uninsured in airport communities than in the rest of King County



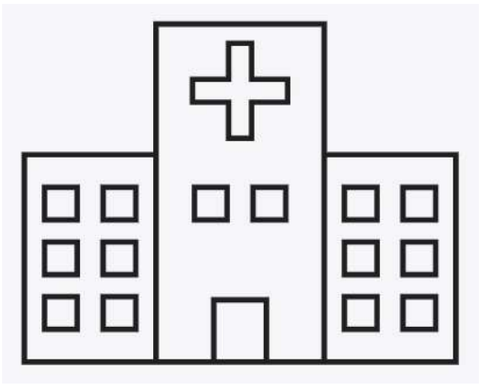
Airport communities had a higher rate of hospitalization from heart disease than the rest of King County

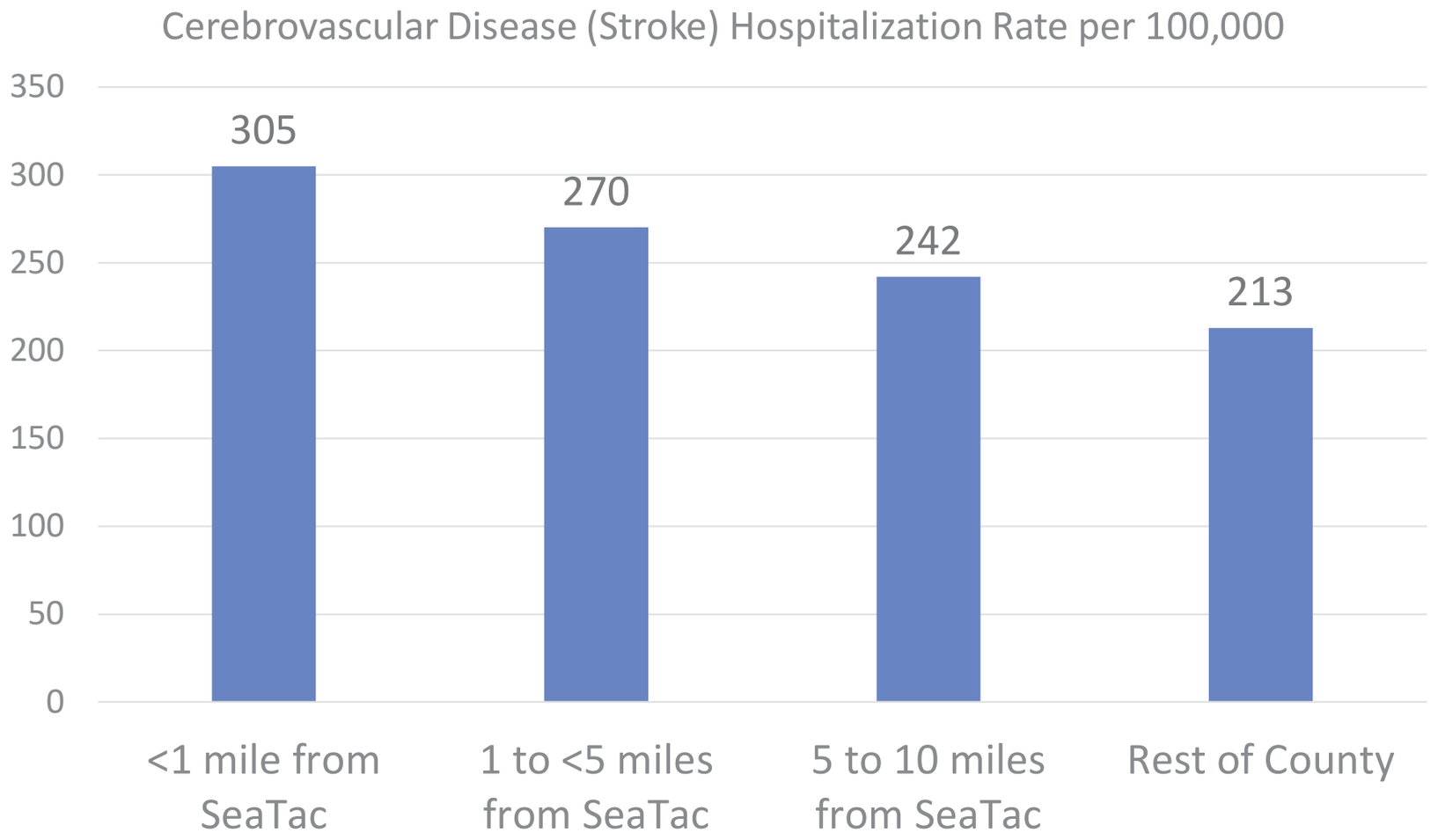




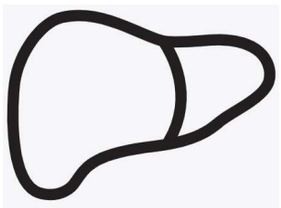


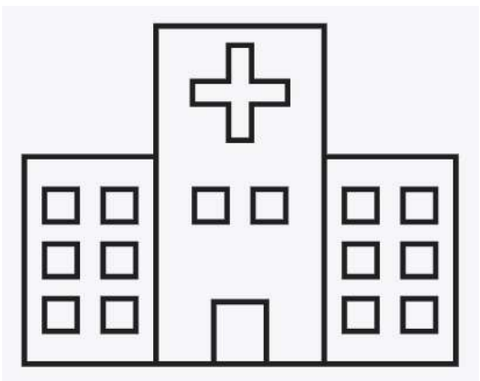
Airport communities had a higher rate of hospitalization from stroke than the rest of King County

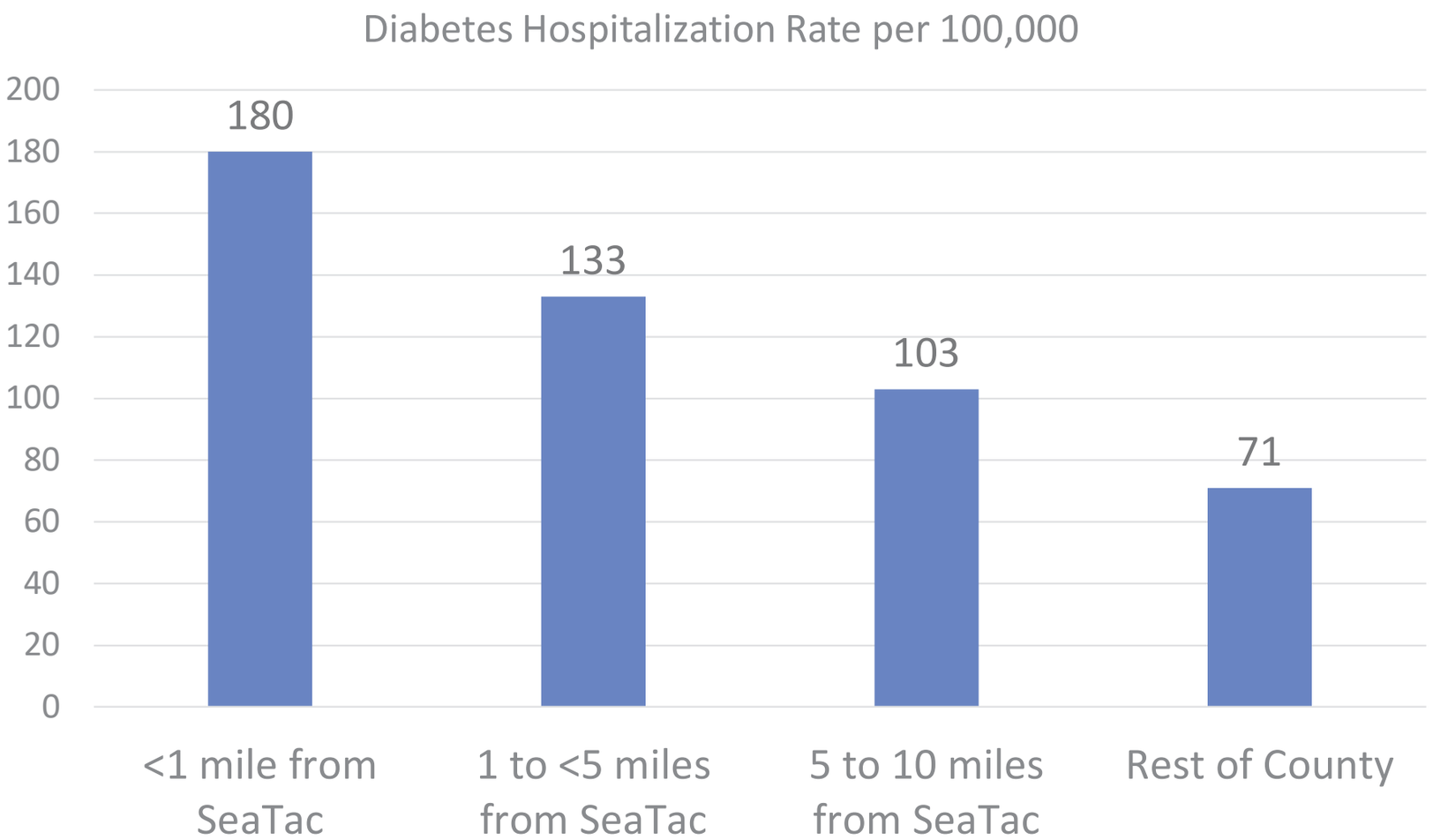




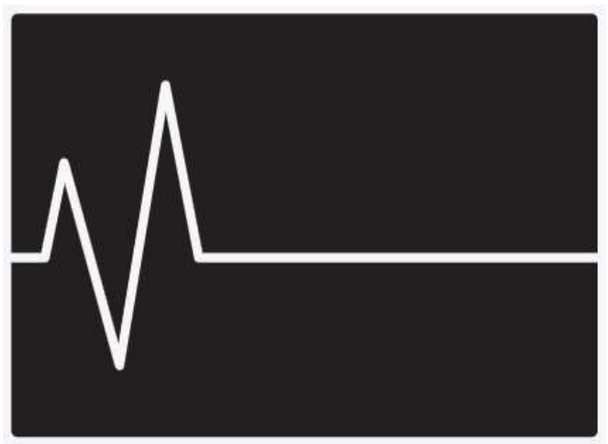
Airport communities had a higher rate of hospitalization from diabetes than the rest of King County

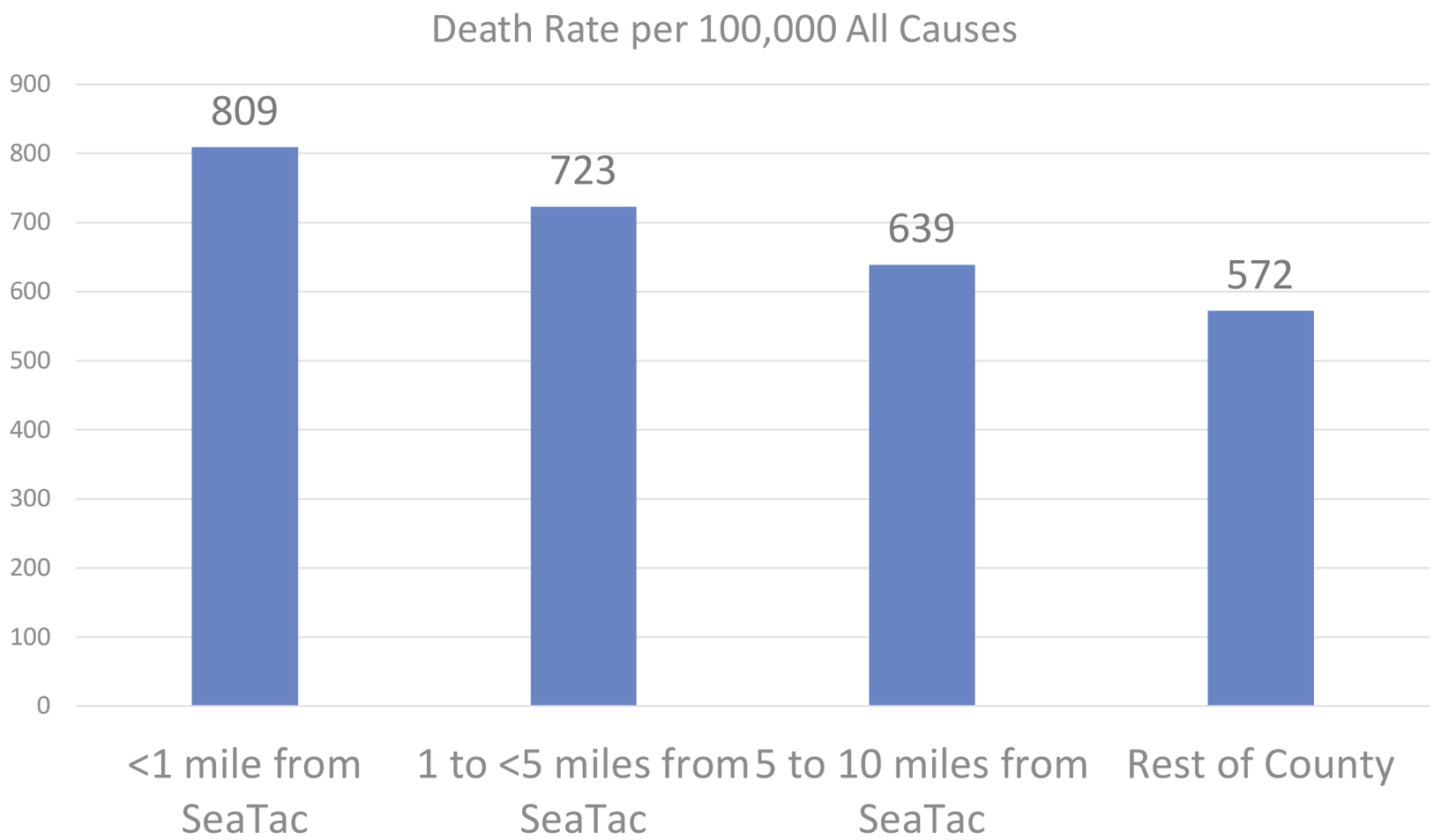






Airport communities had a higher rate of death than the rest of King County





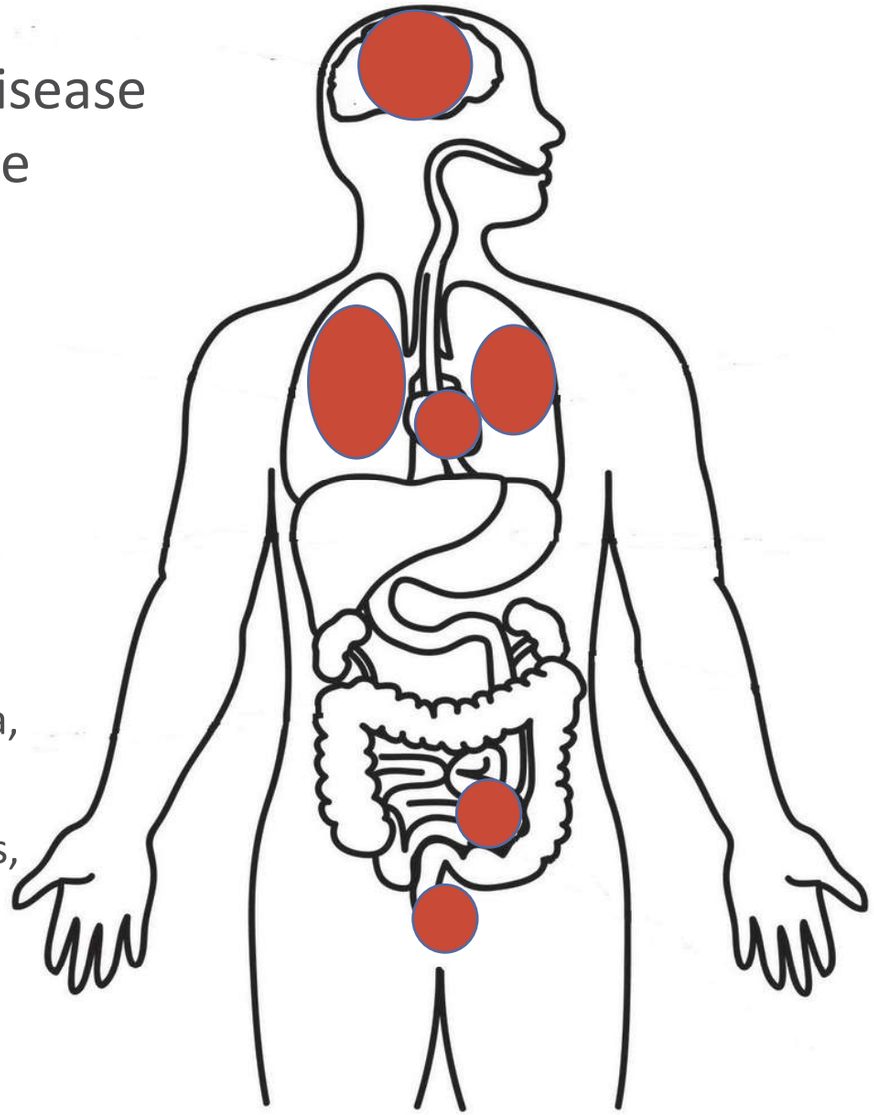
Airport-related Pollutants and Their Likely Health Effects

Noise pollution

- Hypertension & Heart disease
- Poor school performance among children

Air pollution

- Respiratory problems (asthma, respiratory diseases)
- Cardiovascular issues (Hypertension, heart disease/attack, stroke)
- Nervous system (dementia, oxidative stress)
- Metabolic issues (Diabetes, metabolic syndrome)
- Reproductive health concerns



We need to know more about exposure

- Several studies in urban areas identified noise and air pollution related to airports and adverse health effects
- 2018 Beacon Hill study showed that >50% of 24-hour day-night avg noise levels over 65 dB (WHO recommends 45 dB).
- 2019 Puget Sound Clean Air Agency report shows particulate matter levels over EPA-recommended levels 22 days in winter

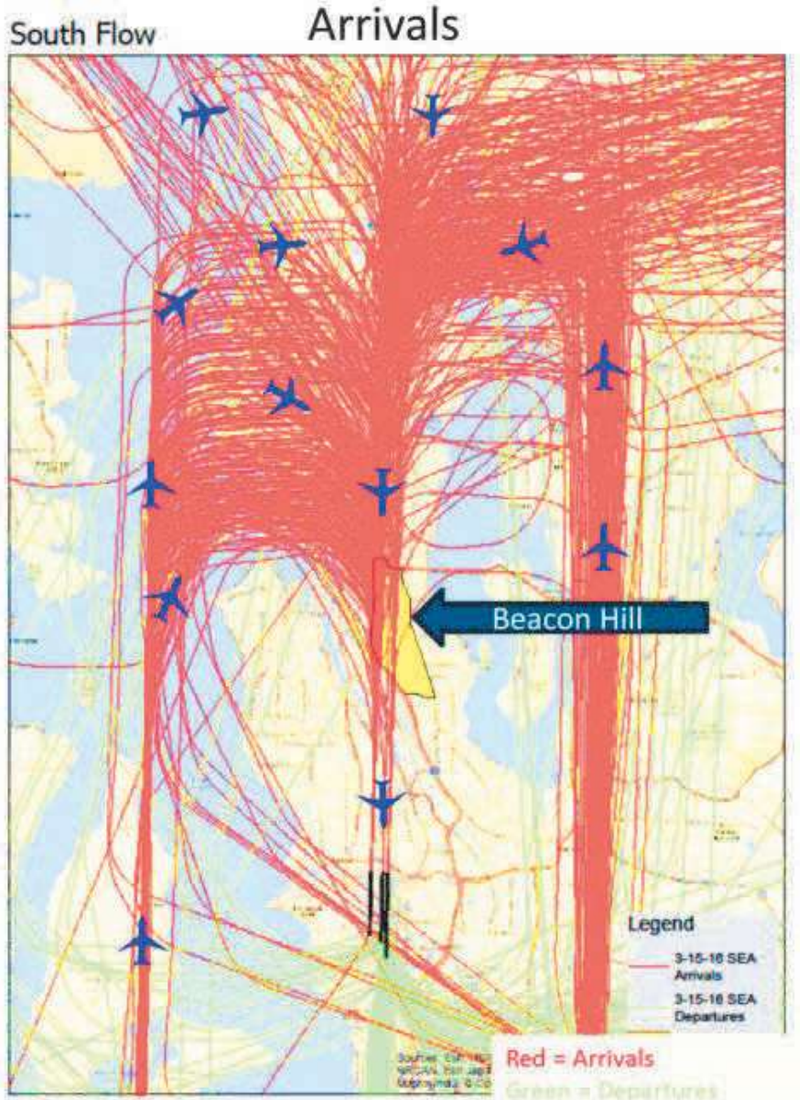


Figure 3. Arrival flight paths for Seattle-Tacoma International Airport. Beacon Hill neighborhood in yellow. Airport runways shown as two black lines center-bottom of image.

MOV-UP Study Objectives

- Study the implications of air traffic at Sea-Tac
- Assess the concentrations of ultrafine particulate matter (UFP) in areas surrounding and directly impacted by air traffic
- Distinguish between and compare concentrations of aircraft-related and other sources of UFP
- Coordinate with local governments, and share results and solicit feedback from community

Ultrafine Particles (UFPs)

Ultrafine Particles unregulated but potentially important in determining health outcomes

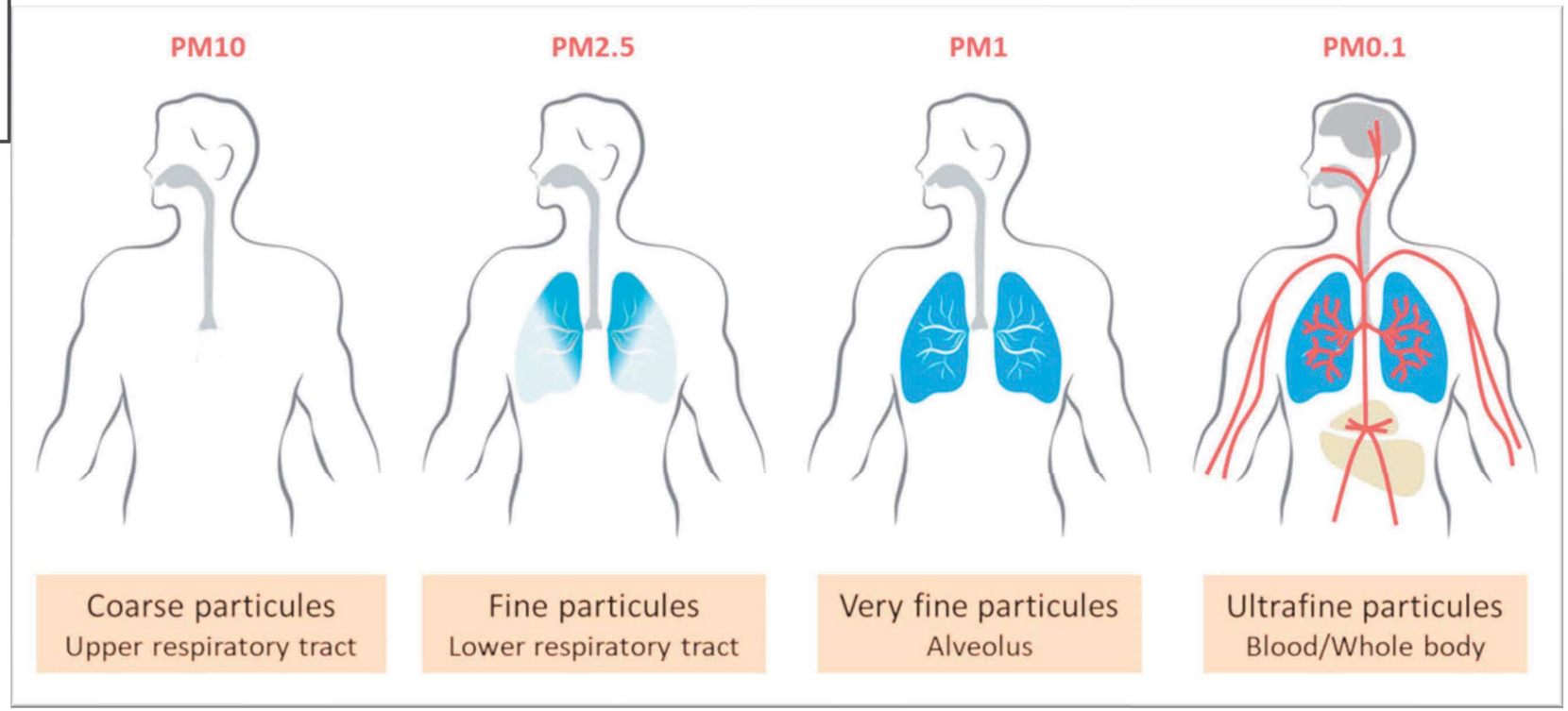
Health Effects more uncertain compared to $PM_{2.5}$, associated with neurological and birth outcomes

Important sources include diesel combustion (truck traffic, aircraft), wood-smoke and photochemical processes

Variable spatial and temporal distribution

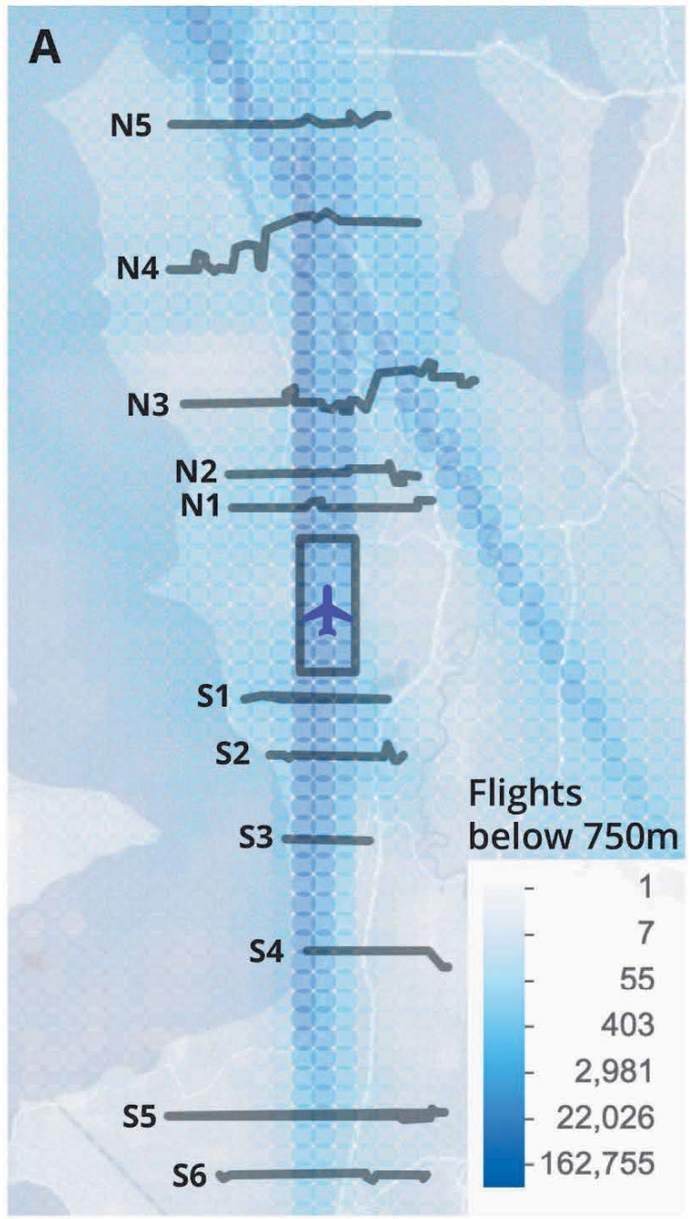
Important characteristic of Ultrafine Particles

- They have a larger surface area, relative to their size.
- They are small enough to enter the bloodstream, cross the placenta, and cross the blood-brain barrier.
- Because they are small, they have very little mass.
- They are measured differently than $PM_{2.5}$ (count for UFP vs mass for $PM_{2.5}$)

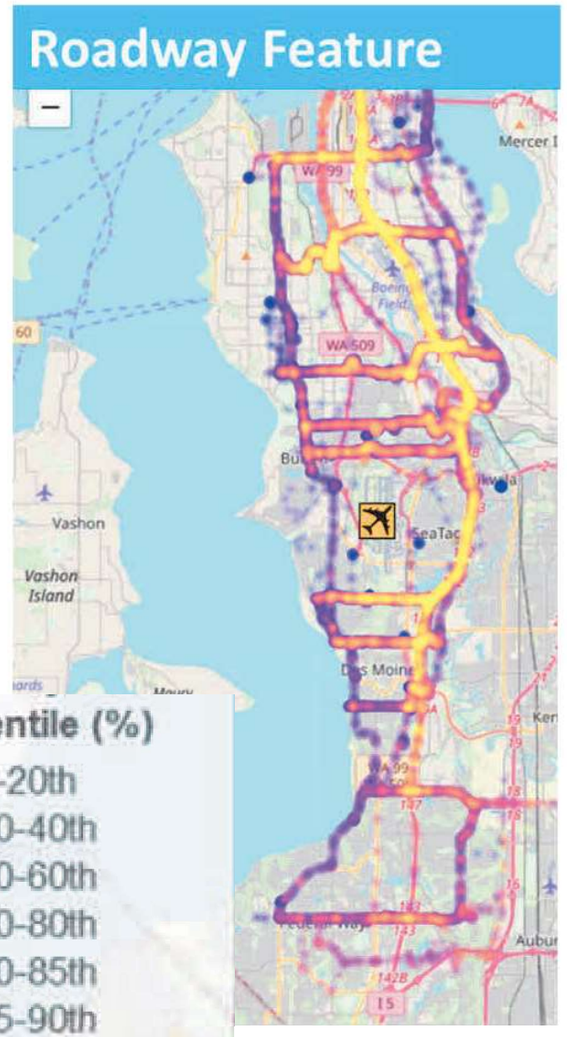


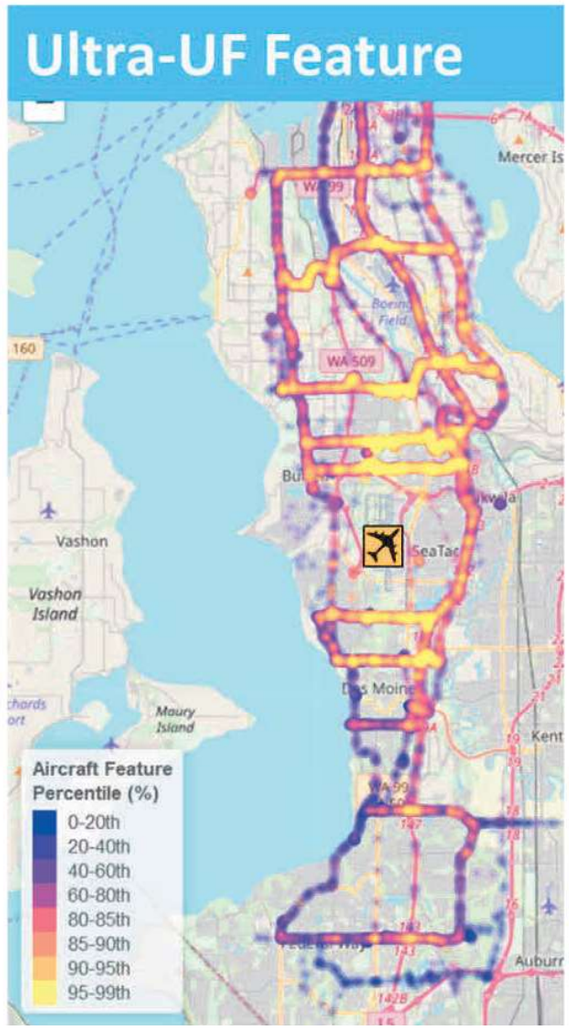
Study Region: Mobile Transects and Fixed Monitoring Site Locations

SEATAC (2018)
- 8th busiest U.S. airport
- > 49.8 million passengers
- >432,315 metric tons of air cargo



- POSITIVELY correlated with Black Carbon and Total Particle Number Concentration
- Median diameter from Nanoscan is approximately 30 nm





- POSITIVELY correlated with ultra-UF particles
- NEGATIVELY correlated with Black Carbon
- Median diameter from Nanoscan is approximately 15 nm

https://doi.org/10.1021/acs.est.0c05933

Study Findings

Understanding the health effects of jet pollution around Sea-Tac Airport

A policy brief for the Washington State Legislature

Summary

Communities underneath and downwind of jets landing at Seattle-Tacoma International Airport are exposed to a type of ultrafine particle pollution that is distinctly associated with aircraft, according to a 2019 University of Washington (UW) study that is the first to identify the unique signature of aircraft emissions in Washington.

The finding comes from the two-year Mobile ObserVations of Ultrafine Particles (MOV-UP) study funded by the Washington State Legislature and led by the UW Department of Environmental & Occupational Health Sciences and the Department of Civil and Environmental Engineering.

The MOV-UP study examined the air-quality impacts of aircraft traffic on communities located

The discovery creates opportunities to investigate the health effects of aircraft-related pollution, how different neighborhoods are impacted by it and specific interventions to reduce people's exposure to these pollutants.

Previous studies have linked exposure to ultrafine pollution particles to breast cancer, heart disease, prostate cancer and a variety of lung conditions.

This policy brief describes some of the remaining knowledge gaps about aircraft-related pollution.

It also proposes next steps that state legislators can take to better understand the health impacts of ultrafine particle pollution and to protect the health of people who live and work in the vicinity of Sea-Tac Airport.

- Ultrafine particles (UFP) are emitted from both traffic and aircraft sources.
- Total concentration of UFP (10 - 1000 nm) did not distinguish roadway and aircraft features.
- The spatial impact of traffic and aircraft UFP emissions can be separated using a combination of mobile monitoring and standard statistical methods.
- There are key differences in the particle size distribution and the black carbon concentration for roadway and aircraft features.
- Fixed site monitoring confirms that aircraft landing activity is associated with a large fraction of particles between 10-20 nm.

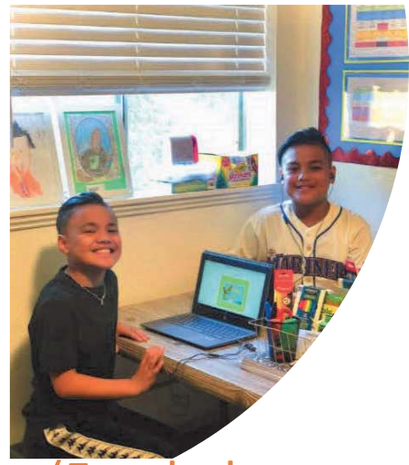
MOV-UP Project Website
https://deohs.washington.edu/mov-up

Emerging Research

- Systematic literature review of air quality in close proximity to airports.
- Association of aircraft UFP and preterm birth at LAX
- Association of aircraft UFP and risk of malignant brain cancer at LAX

“Results from this prospective study suggest that high airport-related UFP exposure is associated with risk of malignant brain cancer. We have captured airport-related UFP as an important source of air pollutant exposure. Further investigation into the role of UFP from additional sources may help to better understand links between air pollutants and malignant brain cancers.”

Next Steps



Research Gaps

Gap # 1: What are the health effects of aircraft UFP?

Gap # 2: What can we do to reduce human exposures to UFP?

Gap # 3: How are concentrations of UFP compare within different communities?

Current Projects

- School Resilience to Air Pollution (Funded by the cities of Burien, Des Moines, Federal Way, Normandy Park, SeaTac)
- Portable HEPA filter intervention. Healthy Schools; Healthy Air (Funded by the State of Washington)
- Wildfire smoke resilience in schools (Funded by the US EPA)
- Characterizing the chemical content of urban nanoparticles will advance our understanding of sources and impacts on communities. (Funded by UW EDGE)

RECOMMENDATIONS

- Address the health disparities of airport communities
- Mitigate the health impacts of airport operations
- Continue development and implementation of strategies to mitigate airport-related air and noise pollution
- Implement new technologies to improve measurement of exposures indoors and outdoors
- Expand the systematic monitoring of pollutants (both outdoor and indoor exposures) in residences, schools, childcare settings, and long-term care facilities
- Support research to address gaps in knowledge

King County's Next Steps

- King County's 2020 Strategic Climate Action Plan calls for a Joint Aircraft Emissions Technical and Community Task Force.
  - Review methodologies to account for aircraft emissions
  - Recommend a baseline level for King County's emissions inventory.
  - Evaluate the effectiveness and feasibility of strategies to reduce aircraft emissions.
- King County will partner with regional agencies such as the Puget Sound Regional Council, Puget Sound Clean Air Agency, and the King County Cities Climate Collaboration to advocate for a regional approach to aircraft transportation planning that can reduce aircraft greenhouse gas emissions.